PROCEEDINGS OF SCIENCE

Search for $Z\gamma$ resonances using leptonic and hadronic final states in proton-proton collisions at 13 TeV with the CMS experiment

Kyungwook Nam[*†]
Seoul National University
E-mail: kyungwook.nam@cern.ch

A search for $Z\gamma$ resonances using leptonic and hadronic final states is presented. The analysis is based on data from proton-proton collisions at a center-of-mass energy of 13 TeV, corresponding to an integrated luminosity of 35.9 fb^{-1}, and collected with the CMS detector at the LHC in 2016. The search strategy is to look for an excess above the nonresonant Standard Model background on the $Z\gamma$ invariant mass spectrum. Leptonic and hadronic decay modes of the Z boson are investigated and the results are combined and interpreted in terms of upper limits on the product of the production cross section and the branching fraction to $Z\gamma$.

The 39th International Conference on High Energy Physics (ICHEP2018)
4-11 July, 2018
Seoul, Korea

[*]Speaker.
[†]On behalf of the CMS Collaboration

PoS(ICHEP2018)895

This paper describes the results of a search for heavy resonances decaying to $Z\gamma$ [1]. The search is based on 13 TeV proton-proton collision data collected by the CMS experiment [2] in 2016, corresponding to the integrated luminosity of 35.9 fb^{-1}. The search strategy measures the non-resonant SM background directly on data, and looks for localized excesses.

In the leptonic channels, the Z boson candidates are reconstructed using electron or muon pairs. In the hadronic channels, they are identified using a large-radius jet, containing either light-quark or b quark decay products of the Z boson, via jet substructure and advanced b quark tagging techniques.

The non-resonant SM background $m_{Z\gamma}$ spectrum can be extracted by an unbinned likelihood fit with a parametric function of $m_{Z\gamma}$: $\text{f}(m_{Z\gamma}) = {m_{Z\gamma}}^{a+b\log m_{Z\gamma}}$. The parametric coefficients are obtained from a fit to the data events, and considered as unconstrained nuisance parameters in the hypothesis test, providing an estimation for the shape of the background $m_{Z\gamma}$ spectrum.

The signal distribution in $m_{Z\gamma}$ is taken from simulation. The simulated signal samples are used in the analysis for two parts: first, it provides the shape of the signal invariant mass spectrum; second, acceptance and selection efficiency are measured using the simulated samples.

No significant excess above expected backgrounds is observed in $m_{Z\gamma}$ spectrum. We set 95% confidence level upper limits on the product of the production cross section and the branching fraction to $Z\gamma$ for narrow- (0.014% of the resonance mass) and broad-width (5.6%) resonances, shown in Figure 1. These limits are the most stringent limits on $Z\gamma$ resonances to date.

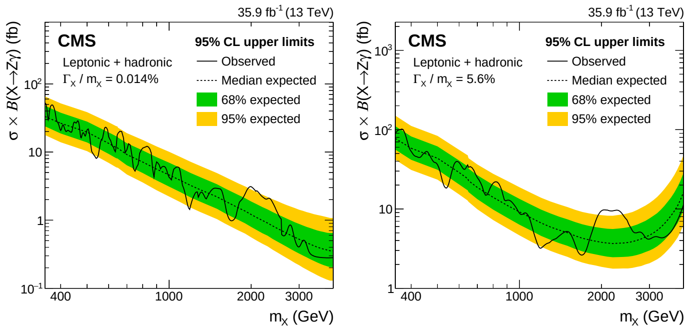

Figure 1: Limits on $\sigma B(Z\gamma)$ obtained by combining leptonic and hadronic channels [1].

Acknowledgments

Kyungwook Nam is supported in part by the National Research Foundation of Korea (NRF) funded by the Korea government (NRF-2018R1A1A1A05077514 and NRF-2015R1A4A1042542).

References

[1] CMS Collaboration, "Search for Zγ resonances using leptonic and hadronic final states in proton-proton collisions at $\sqrt{s} = 13$ TeV", *JHEP* **09** (2018) 148

[2] CMS Collaboration, "The CMS experiment at the CERN LHC", *JINST* **3** (2008) S08004.